

Importing, Sure, But: From Where?

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Capacity Adequacy

“The system’s ability to establish market equilibrium in the day-ahead market, and ... provide adequate balancing resources for real-time operation, even in extreme situations.” [1]

Moreover [1]

- Peak load: Is there sufficient capacity (including demand response) to handle peak load situations?
- Flexibility: Is the capacity (including demand) sufficiently flexible to handle variations in load and balance the system in real-time?
- Energy back-up: Is there sufficient energy back-up capacity to serve demand during prolonged periods of low wind and solar generation?

Capacity Adequacy in Europe: Background

- Before deregulation: capacity adequacy typically not an issue in developed countries with electricity monopolies
 - When Europe deregulated (nineties and early twentieth century): relatively large reserve margins
- ==> Regulators focused on competition and market power

What has Changed over the Last Decade?

- Large scale introduction of renewables, with high intermittency
- Nuclear phase-out
- Lack of profitability of thermal capacity
 - ==> Limited new investments
 - Mothballing/closure of fairly recent plants

==> Regulators start questioning future capacity adequacy

A look at Selected European countries (I)

- **England and Wales:** Net importer in winter
Consider interconnectors as part of capacity
Scenarios show risk of shortages at same time as interconnected neighbours
- **Germany:** Scenarios indicate that cross border interconnection insures sufficient supply, but local shortages possible
- **France:** Large share of electrical heating
==> high vulnerability during cold spells in winter, when little PV
(52 days of net-imports in 2018)
- **Netherlands:** Expect to import during hours of scarcity

A look at Selected European countries (II)

- **NordPool:** Eastern Norway and parts of Sweden: risk of shortages, partly due to limited transmission capacity
Denmark: likely to depend on imports when wind generation is low
Finland: import dependence at peak times
- **Belgium:** Scheduled nuclear phase-out
==> Significant dependence on imports at peak times during periods with limited wind and sun, despite major investment plans
- **Switzerland:** Depends heavily on imports in winter despite large hydro-storage reservoirs, including pump-storage
Has become a net importer in recent years
Situation will worsen with the nuclear phase-out.

Regulators' and policymakers' solution

Importing from interconnected countries to cover occasional deficits

Illustrative quotes:

- **Belgium:** *“It is assumed that the large countries (Germany, France, Great-Britain) cannot allow themselves to depend on neighbouring countries for their security of supply, or only to a limited degree (as is the case for France).” [2]*
- **Germany:** *“System adequacy in Germany can only be considered and assessed in a transnational perspective as the German electricity grid is closely interconnected with the electricity systems of the neighbouring countries. Furthermore, electricity is traded cross-border and considerable port-folio effects exist in the European interconnected system.”[3]*

European Capacity mix and Demand: Evolution

Country	Total Capacity (MW)		Renewable Capacity(MW)		Demand (TWh)	
	2005	2016	2008	2016	2005	2016
Belgium	16,096	21,544	1,167	6,704	87	85
Nederland	21,800	34,176	3,159	7,185	99	115
France	115,730	130,794	27,801	44,129	576	556
England & Wales	82,378	97,640	7,093	35,505	398	339
Luxembourg	1,682	1,709	114	300	4	2
Switzerland	17,440	20,839	13,420	16,313	57	58
Germany	128,485	208,500	38,649	104,746	622	649
Denmark	13,036	14,337	3,969	7,390	36	30

- Large amounts of intermittent renewables replace thermal and nuclear capacity
- Convergence of technologies

Discussion

- Looming capacity adequacy problems in Northern and Western Europe
 - Generation technologies converge towards intermittent renewables
=> Increasing risk of simultaneous shortages
(cold, windless winter evenings)
 - Review concept of capacity margin based on peak demand due to intermittent generation
 - Need to reconsider the definition of capacity adequacy:
national vs regional definition, role of and reliance on transmission,
priority rules when simultaneous shortages in interconnected countries,
use of (cross-border) capacity mechanisms, need for thermal capacity,
role of storage (timing of generation), etc.
- => Need to reconsider the way in which markets are regulated:
Transnational regulatory coherence

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References

[1] Thema (2015) Capacity adequacy in the Nordic electricity market. Nordic Council of ministers.

[2] Elia (2016) Etude de l'adéquation et estimation du besoin de flexibilité du système électrique Belge, Période 2017-2017

[3] BWMi (2016) Electricity 2030. Berlin